REMARKS

The Examiner has rejected claims 2-29, 31-36, and 40-44 under 35 USC §103(a) for the reasons cited in the office action using the Petry patent as the main reference with the addition of the Clark patent. Applicant respectfully requests reconsideration of these claims based on the following.

It can be shown that the teachings of Petry, Clark, and Dent are counter to the claims of the present invention. One following the teachings of Petry, Clark and Dent would not be able to construct the present invention. A review of present invention is followed by review of Petry, Clark, and Dent.

The present invention provides for a means for *multiple access* using the Ethernet switch and multibeam antenna. *Multiple access* means that the Ethernet Switch and multibeam antenna, together, automatically provide for a multiplicity of simultaneous users to one hub. This is done using the Ethernet Switch's Media Access Control (MAC), or network, address table. The MAC, or Network, address is a unique address identifying any device connected to an Ethernet network. Each port on an Ethernet switch has a Network Address, and a Network address table. This table is a record of all devices connected to that particular port. The Ethernet switch directs network traffic by scanning a data packet's destination network address, and forwarding the data packet to the correct switch port. The Ethernet switch automatically "learns" what devices are connected to it by scanning the source network address of packets coming into the switch port, adding that source network address to that switch port's network address table, and thereafter, forwards data packets with that same address as the destination network address to that port.

By connecting a dedicated, static, antenna beam to the one switch port, the present invention allows for the Ethernet switch to build a network address table which includes the network address for each device in each beam. Once the switch learns what devices are in each beam, it will automatically forward data packets to the correct beam. By providing multiple, simultaneous beams through the antenna, the number of network addresses in each port's network address table can be reduced by a factor of the number of antenna beams, thereby improving data throughput and increasing the total number of devices simultaneously served by

the hub. This is a novel and unobvious approach to pro-viding *multiple access*. Petry's teaching specifically precludes this form of *multiple access*.

Importantly, the examiner states that Petry teaches a multi-beam antenna. Petry does not use the term multi-beam antenna anywhere in the Petry patent. The use of a beamformer does not imply a multi-beam antenna of the type described in the present invention. The multi-beam antenna, as described by the present invention, is a special class of multibeam antenna which uses a passive, reciprocal, NxN matrix to create a fixed beam. This type of multibeam antenna is mathematically defined by the authority Allen[1] in a proof. In the cited reference, Allen concludes:

"It has been shown that for a passive, reciprocal matrix **(as described in present invention)** ***to form simultaneous independent beams*** **(i.e a multibeam antenna)** ***in a lossless manner, the shapes*** **(of the antenna beams)** ***must be such that their space factors are orthogonal*** **(fixed in position relative to each other, as described in present invention)** ***over the interval period of the antenna pattern for the array type assumed; i.e. linear, with equispaced radiators."***

Additionally, the authoritative *Handbook of Antenna Design*, Chapter 6, entitled "Multiple Beam Antennas", describes the MultiBeam Antenna (MBA) as follows:

"An MBA can be ....a planar array excited by a Butler beamforming network, or some variation and/or combination of these. Impressing a signal on one of the N ports produces a beam pointing in a direction unique to that port. The N beams produced by exciting each port individually define, or span the field of view (FOV) of the MBA. These beams are a fundamental basis for any radiation pattern produced by the antenna system." [2] **(The Butler Matrix is another name for the passive, reciprocal, NxN matrix described in the present invention).**

As will be shown, Petry describes an antenna and <u>non-passive</u> (or active) beamformer which shapes a beam by electronic adaptation using weights, rather than a passive, reciprocal, beamformer and fixed simultaneous beam antenna as described in the present invention.

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[1] J.L. Allen, "*A Theoretical Limitation on the Formation of Lossless Multiple Beams in Linear Arrays*", IRE Transactions on Antennas and Propagation, July 1961, page 350-352

[2] L.J. Ricardi "*Handbook of Antenna Design, Vol. 1*" Published by Peter Peregrinus LTD, 1982. Chapter 6 pages 467-468

Review of present Invention

In the Detailed Description of the present invention, and referencing Figure 3, the present invention is described as follows:

"*Each of the radio transceivers can be ported to a full duplex Ethernet switch port, providing dedicated, full duplex throughput at whatever data rate the radio transceiver and Ethernet switch will support*". (Page 5, Lines 25, 26, 27)

This means that each radio transceiver has a unique Network Address, as it is ported to a single Ethernet switch port. Note in the figure 3 that the number of Ethernet switch ports is identical to the number of radio transceivers.

Futhermore, the description of the present invention says-

"*There are switch ports on the Ethernet switch for each individual hub radio transceiver.*" (Page 6, lines 8, 9)

Which re-emphasizes that there is a unique Ethernet switch port and, consequently, a unique Network address for each radio transceiver.

The description of the present patent says that –

"*The hub radio transceivers provide the interface from the Ethernet to the multi-beam antenna assembly. The hub radio transceivers are connected to the beam-former of the multi-beam antenna assembly. The multi-beam antenna assembly generates directive beams in space, which are able to partially isolate the transmissions and receptions of each of the hub radio transceivers from one another*" (Page 6, Lines 13-18)

Again, referencing figure 3, it can be seen that each antenna beam has a dedicated and unique switch port and, therefore, unique Network Address. This provides for a means of multiple access.

Also, the description of the present invention clearly states that it is intended to provide multiple access:

"*Fig. 8 shows schematically the use of the system in providing multiple access to different remote stations*" (Page 9, lines 16-17)

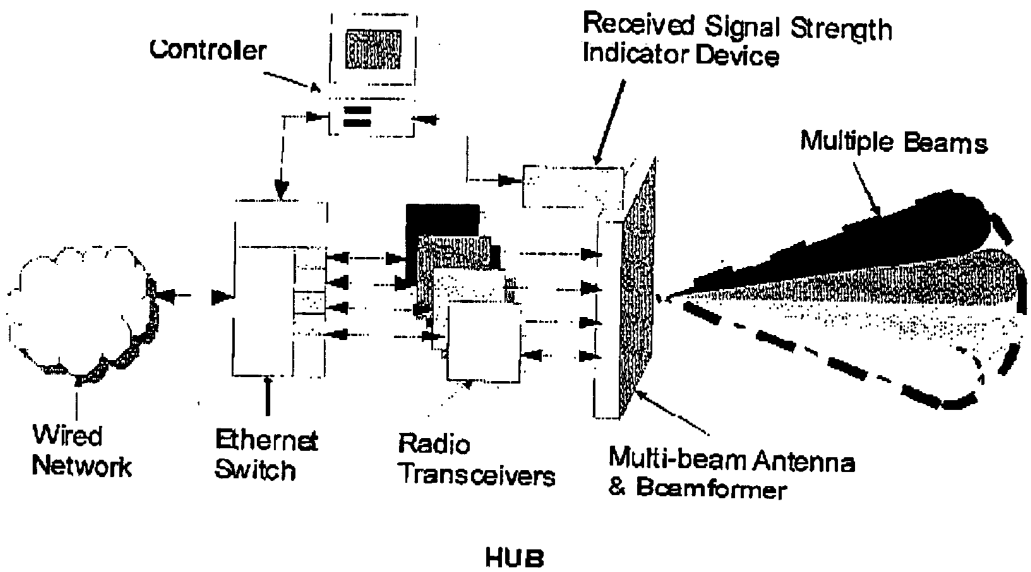


Fig. 3

Referencing figure 5, the present invention describes the use of fixed beam multi-beam antennas –

"Each mainlobe antenna beam is associated with an individual input port. As shown in figure 5, input port 18 is associated with mainlobe 36, input port 20 is associated with mainlobe 40, input port 22 is associated with mainlobe 34, input port 24 is associated with mainlobe 38". (Page 7, Lines 18-21)

and

"Each beam of the multiple beam antenna is associated with a single transceiver." (Page 7, Line 24,25).

This describes that each beam of the antenna, connected to a radio transceiver and an Ethernet switch port, has a dedicated and unique switch port, and consequently, each fixed antenna beam has a unique Network Address.

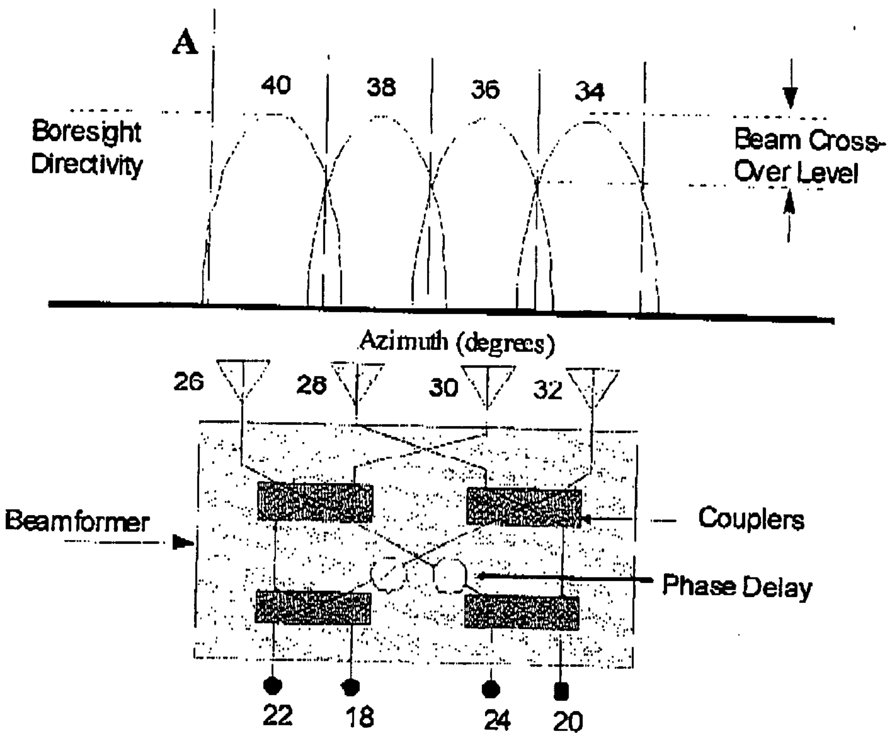


Fig. 5

Referencing figure 5, The multibeam antenna is further described-

"As shown in figure 5, the multibeam antenna at the hub generates N independent beams from N independent inputs, using a N x N hybrid coupling matrix beamformer" (Page 17, Lines 13-15)

and,

"In space, radiations from the individual radiators combine to form the individual beam patterns. The beam patterns 34, 36, 38, 40 formed by the radiators have directivity at a certain azimuthal postion. The beam patterns 34,36,38,40 overlap at a point in the beam pattern 34,36,38,40 called the beam crossover level." (Page 8, Lines 8-12)

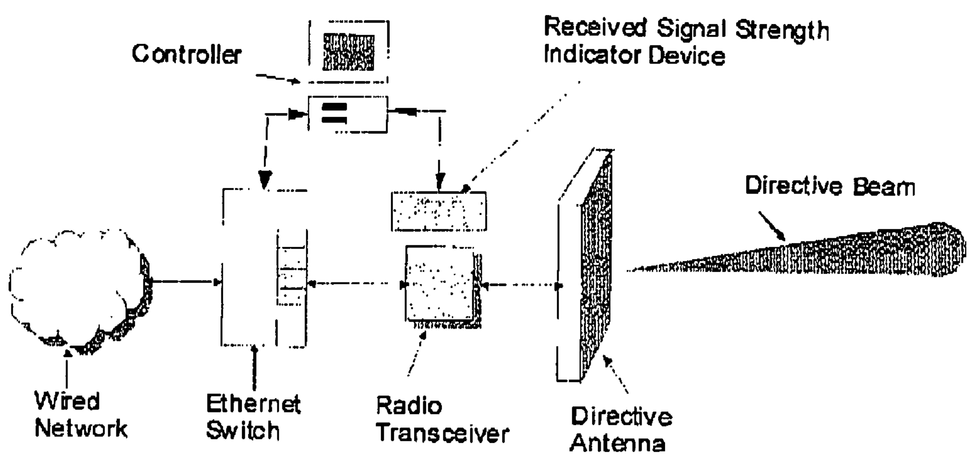
The type of multibeam antenna described has fixed (non-steerable), simultaneous beams in space, each with a Network Address. The multi-beam antenna as described in the present invention is not simply an antenna with multiple, adaptive beams as described by Petry. Rather, it is a class of antenna with simultaneous beams, fixed in number, shape, and (azimuth, elevation) position.

Finally, referencing figure 4, the description of the present patent says-

"The remote station includes a remote station radio transceiver that is synchronized to communicate in the same frequency band with the associated hub receiver. The remote station radio transceiver interfaces a local network, which can be either through an Ethernet Switch, or directly into a wired network." (Page 6, Lines 25-30).

One knowledgeable in the operation of an Ethernet switch will recognize that when the hub Ethernet switch detects transmissions from the remote station, it adds the network address of the remote switch to that particular hub switch port's network address table. Likewise, when the remote station detects transmissions from the hub switch port, it adds the network address of that hub switch port to the remote switch's network address table.

The combination of fixed, simultaneous antenna beams and their respective dedicated switch port with unique network addresses is how the present patent automatically learns which beam the remote station is in, and automatically forwards data packets to the correct destination locations, simultaneously. This is a novel and unobvious solution.



REMOTE STATION

Fig. 4

Regarding claims 2-3, 8-9, 11-13, 19, 26, 31-34 and 40-42

Regarding Claim 8 & Petry

Petry, on the other hand, describes a much different form of *multiple access*. Petry teaches away from the present inventions, enumerated as follows:

Importantly, the examiner states that Petry teaches a multi-beam antenna. Petry does not use the term multi-beam antenna anywhere in the Petry patent. The use of a beamformer does not imply a multi-beam antenna of the type described in the present invention. The multi-beam antenna, as described by the present invention, is a special class of multibeam antenna which uses a passive, reciprocal, NxN matrix to create a fixed beam. This type of multibeam antenna is mathematically defined by the authority Allen[3] in a proof. In the cited reference, Allen concludes:

"*It has been shown that for a passive, reciprocal matrix* (as described in present invention) *to form simultaneous independent beams* (i.e a multibeam antenna) *in a lossless manner, the shapes* (of the antenna beams) *must be such that their space factors are orthogonal* (fixed in position relative to each other, as described in present invention) *over the interval period of the antenna pattern for the array type assumed; i.e. linear, with equispaced radiators.*"

Additionally, the authoritative *Handbook of Antenna Design*, Chapter 6, entitled "Multiple Beam Antennas", describes the MultiBeam Antenna (MBA) as follows:

"*An MBA can be ………… a planar array excited by a Butler beamforming network, or some variation and/or combination of these. Impressing a signal on one of the N ports produces a beam pointing in a direction unique to that port. The N beams produced by exciting each port individually define, or span the field of view (FOV) of the MBA. These beams are a fundamental basis for any radiation pattern produced by the antenna system.*" [4] (The Butler Matrix is another name for the passive, reciprocal, NxN matrix described in the present invention).

As will be shown, Petry describes an antenna and <u>non-passive</u> (or active) beamformer which shapes a beam by electronic adaptation using weights, rather than a passive, reciprocal, beamformer and fixed simultaneous beam antenna as described in the present invention.

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[3] J.L. Allen, "A Theoretical Limitation on the Formation of Lossless Multiple Beams in Linear Arrays", IRE Transactions on Antennas and Propagation, July 1961, page 350-352

[4] L.J. Ricardi *"Handbook of Antenna Design, Vol. 1"* Published by Peter Peregrinus LTD, 1982. Chapter 6 pages 467-468

1. In the Detailed description of the Patent, Petry teaches-

"The information as to for which subscriber stations links are to be established and disconnected can be exchanged via a signaling channel between the subscriber stations and the central station. For such a signaling channel, it is expedient if an antenna of the central station provided for this purpose produces an omnidirectional characteristic which covers all subscriber stations TS1 . . . TS6 simultaneously" (col. 3 lines 1-7)

As described above, the present patent describes how the Ethernet switch automatically establishes connections. Petry teaches away from this by describing a signaling channel with omni-directional characteristic. An "omni-directional" characteristic would preclude the multiple access functionality of the present invention, which uses a Network Address for each beam for multiple access.

2. Petry teaches that-

As shown in FIG. 2, such an array antenna is comprised of a plurality of antenna elements A1, . . . Ai, . . . AI. These antenna elements A1 . . . AI are so distributed that, given appropriate control via beam-forming networks BF1, . . . , BFl . . . , BFL, they produce any radiation lobe desired with regard to direction and opening angle or beam angle. (Col. 3, lines 13-19).

The present patent is fundamentally based on a class of multi-beam antennas which form fixed beams in space, whereas Petry teaches a beamforming network which produces any radiation lobe desired. This teaches away from the present patent. Petry does not describe or reference multi-beam antennas. The examiner states that Petry describes a multi-beam antenna, however, Petry never describes a multi-beam antenna. The description of a beam-former does not imply a fixed beam multibeam antenna of the class described in the present invention. Petry's beamformer is for the generation of arbitrary antenna beams.

3. Petry teaches that

In the transmission case, a multiplexer, and in the reception case, a demultiplexer is switched between each individual antenna element A1 . . . AI and beam-forming networks BF1 . . . BFL. In FIG. 2, multiplexers and demultiplexers are designated with the shared reference numerals DMX1, . . . , DMXi . . . , DMXI. If, for example, a communication channel NKL is supposed to be emitted with a lobe completely predetermined with regard to direction and opening angle, then this channel NKL is split up in beam-forming network BFL into as many individual signals as there are antenna elements A1 . . . AI for producing the appertaining transmission lobe. Each of

these individual signals is multiplied by a weighting factor w1L, . . ., wiL . . ., wIL. These weighting factors are filed as vectors in a separate memory device and are so calculated that, in their sum, the signals weighted by them and supplied to the individual antenna elements A1 . . . AI form the desired transmission lobe. Multiplexers DMX1 . . . DMXI, connected in series to antenna elements A1 . . . AI, combine the weighted signals of all communication channels NK1 . . . NKL determined for the respective antenna element A1 . . . AI". (Col. 3 lines 24-43).

Petry teaches the use of multiplexers to switch between antenna elements, and the use of weighting factors to steer antenna beams. Again, the present patent must use *fixed* beams in space and the Ethernet Switch to automatically assign a Network Address to those remote stations within the fixed beam.

4. Petry teaches that:

"The type of multiplexer DMX1 . . . DMXI depends on whether the radio relay system is used in frequency division multiple access (FDMA), time division multiple access (TDMA) or code division multiple access (CDMA) operation. In the reception case, the partial signals received from the individual antenna elements A1 . . . AI are combined in reverse direction, appropriately weighted, and from that the received communication channels NK1 . . . NKL are derived". (Col. 3 lines 45-53)

In the Petry patent, multiple access is achieved by FDMA, TDMA, or CDMA, whereas the present invention uses the Ethernet switch Network Address assigned to fixed antenna beams, for multiple access. Again, Petry teaches away from the present patent.

5. Petry teaches that:

"The sector and lobe partitioning can be the same for the transmission direction and for the reception direction. However, they can also be different for both directions, depending on what has the more favorable effect on the signal-transmission quality". (col. 3 lines 60-64)

With the present invention, since the remote station is assigned a unique Network address by antenna beam, the transmission and reception lobe must be the same. The fixed beam multibeam antennas described in the present invention precludes asymmetry between transmission and reception lobes as Petry describes. Again, Petry teaches away from the present invention.

6. Petry teaches that:

"Along the lines of power savings, it is advantageous if the antenna of central station ZS only produces a link to a subscriber station when a message exchange is supposed to take place

between the two. When the message exchange has ended, the antenna of central station ZS disconnects the link again." (Col. 2 lines 62-67).

With the present invention, the antenna beam shapes are, by definition, static. The antenna of the central station does not change the status of the link dynamically as described by Petry. Again, Petry teaches away from the present invention.

Regarding Claim 8 -Clark

The Clark patent is a comprehensive network concept, which teaches only the use of Ethernet packet communications as one possible mode of information transportation.

1. Clark teaches:

"*In one embodiment, the microwave communication system transfers information using multiple relay stations via an ethernet packet switching protocol such as the IEEE 802.10 protocol or the TCP/IP protocol used on the World Wide Web. By using the ethernet packet communication, multiple applications may access the microwave links at any one time. The wireless LAN also utilizes the ethernet protocol to transfer information.*" (Col. 2 lines 49-56)

and

"*Although the present invention is described with use of the TCP/IP Internet protocol, other protocols may be used. For instance, other protocols which may be employed by the present invention include asynchronous transfer mode (ATM), Internet Packet Exchange (IPX) protocol, Lotus Notes, SMNP, NNP, Multiple Internet Mail Exchange (MIME), IP (Internet protocol)–ATM, Web Network File System (WNFS), File Transfer Protocol (FTP), Fiber Distributed Data Interface (FDDI), Reliable Multi-cast Transfer Protocol (RMTP), and Multiprotocol OVER ATM (MPOA).*" (Col. 3 lines 1-10)

The Ethernet is taught as a protocol for transporting information between relay stations and supporting *multiple applications* (this is different from *multiple access* for multiple users), not as a means of automatically providing for multiple access using fixed beam antennas as described in the present invention. Clark actually teaches away from using the Ethernet switching technology for multiple access, by citing *multiple relay stations*. Clark also teaches away from the present invention by describing other protocols, all of which would preclude use of the present invention.

2. Clark teaches:

"In one embodiment, a 10-100 Mbts ethernet switch is located at each microwave site to serve as a bridge between the wireless downlink to the remote location and the microwave backbone." (Col. 4 lines 26-31)

The Bridge is a traditional application of an Ethernet switch to act as a connection in a point to point Ethernet network. Clark has no provisions for multiple access as described in the present invention. Clark teaches away from the present invention by citing the Ethernet switch to serve as a point to point *bridge* between a wireless downlink and a microwave backbone.

Regarding Claim 4- Dent

1. **Dent teaches:**

"The power amplifier matrix can be a bank of n separate amplifiers each associated with respective beams , or a bank of N (greater or equal to n) amplifiers coupled by nXN Butler matrices at their inputs and Nxn Butler matrices at their outputs. The effect of the Butler matrices is to use each amplifier to amplify part of every beam signal, thus evening out the load...and reducing intermodulation". (Col. 9 lines 18-24)

Dent describes the use of the nXN matrix for reducing load on amplifiers, for which the matrices are commonly used. He does not suggest using the nXN hybrid coupling matrix for multiple access.

2. **Dent teaches:**

"These video signals, for example occupying the band 1-7 MHz are then upconverted in respective upconverters 320, using a common local oscillator 330 to preserve relative phase relationships, and then amplified using a power amplifier matrix 310 for transmission via multibeam antenna 300 to the mobile phones". (Col 9 lines 8-14)

Dent describes a manner to distribute video signals, but this does not suggest a method for multiple access in an Ethernet data network. The cell phones described are not Ethernet network devices with a corresponding network address for the hub network address table to be built upon as described by the present invention. Dent is teaching away from the present invention.

3. Dent teaches

"Then the removed row of C is used to augment in turn each of the C matrices associated with other groups of mobiles using different frequency channel (FDMA) or multi-carrier (CDMA) or timeslots (Time Div. Multiple Access) and the above expressions computed to determine the increase in power that would be necessary to support the mobile as a member of each of the other groups in turn". (Col. 24, lines 7-17).

Dent describes dynamic matrices (C-matrices) serving mobile stations using three different forms of multiple access (Freq. Div. multiple access, Code Div. Multiple Access, Time Div. Multiple Access). The present invention uses a static hybrid matrix to serve stationary stations, using the Ethernet network address table for multiple access. Dent is teaching away from the present invention.

Hence, applicant believes that the rejection of claims 2-29, 31-36, and 40-44 under U.S.C. § 103(a) is invalid, as the references actually teach away from the invention as claimed. Applicant believes that the Examiner has not met the duty to show the incentive to combine the teachings of the reference under the U.S.C. § 103(a) rejection to produce the invention as claimed. In *Ex parte* Skinner, 2 USPQ2d, 1788, 1790 (B.P.A.I. 1986), The Board explained:

> When the incentive to combine the teachings of the reference is not readily apparent, it is the duty of the examiner to explain why combination of the reference teachings is proper....Absent such reason or incentives, the teachings of the references are not combinable.

In view of the aforementioned remarks and amendments, it is believed that claims 2-29, 31-36, and 40-44 are in condition for allowance and allowance of these claims is respectfully requested.

Respectfully submitted,

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